

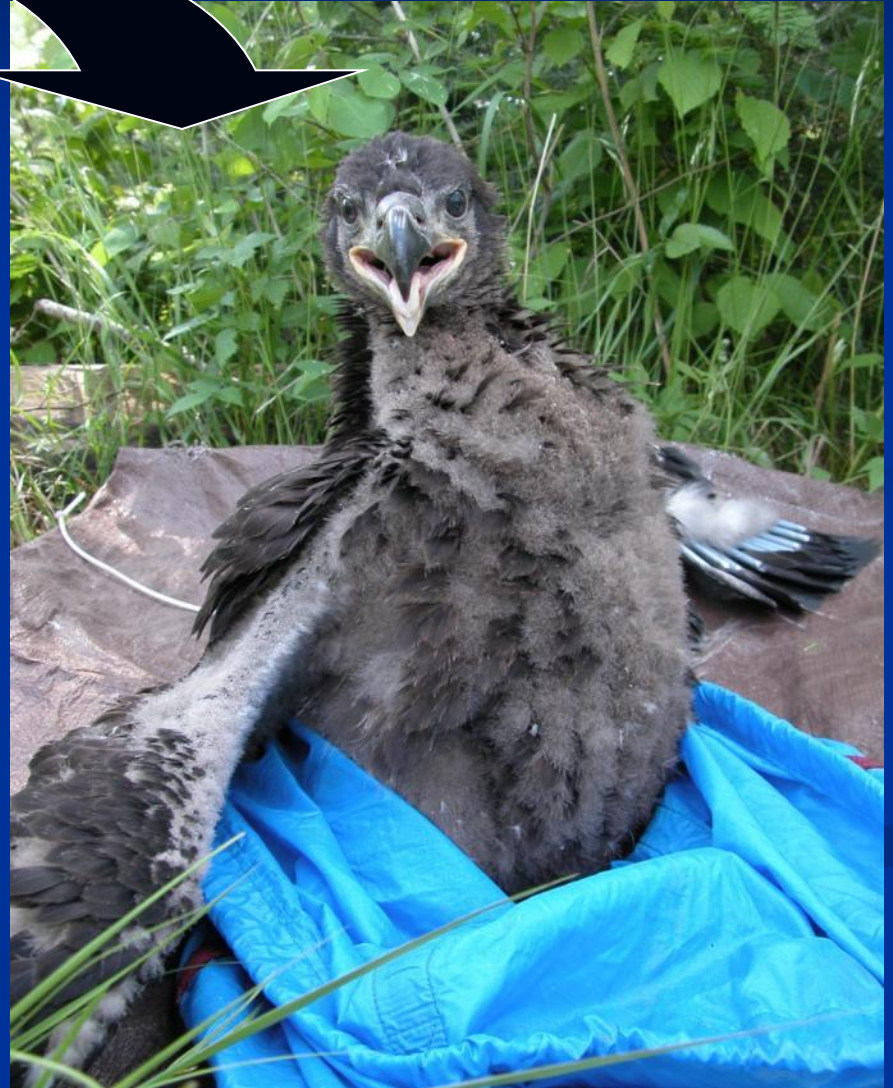
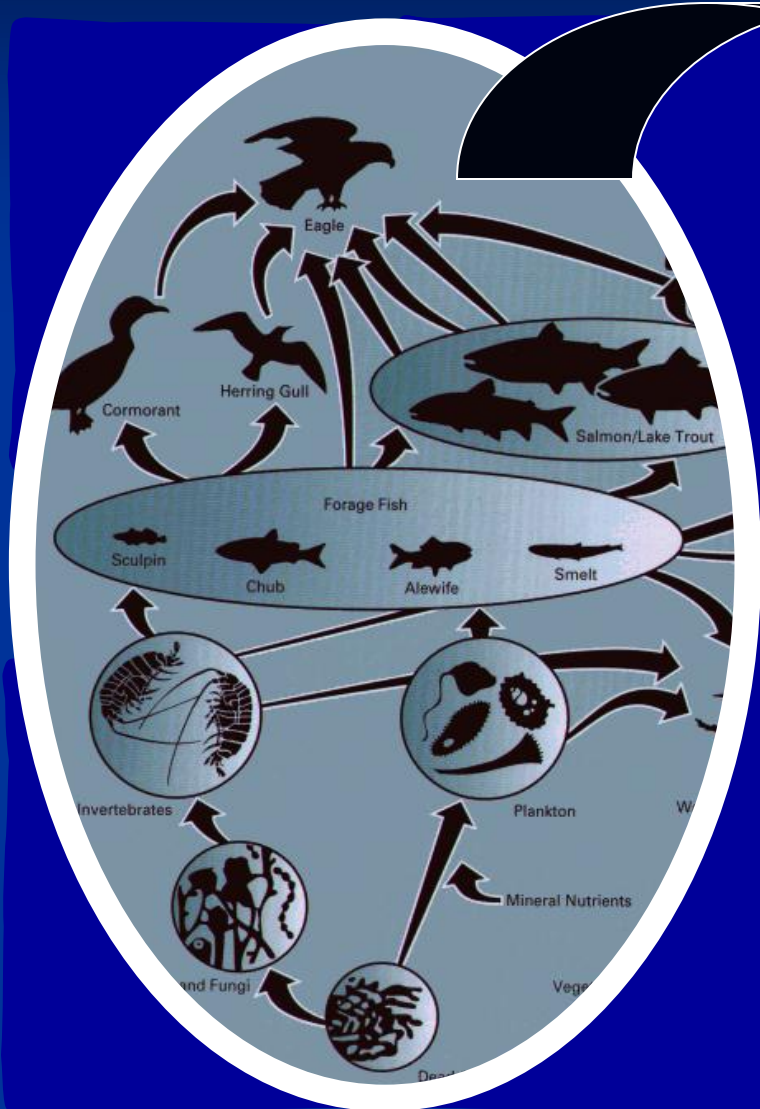
MONITORING PERSISTENT CONTAMINANTS IN BALD EAGLES

Bill Route

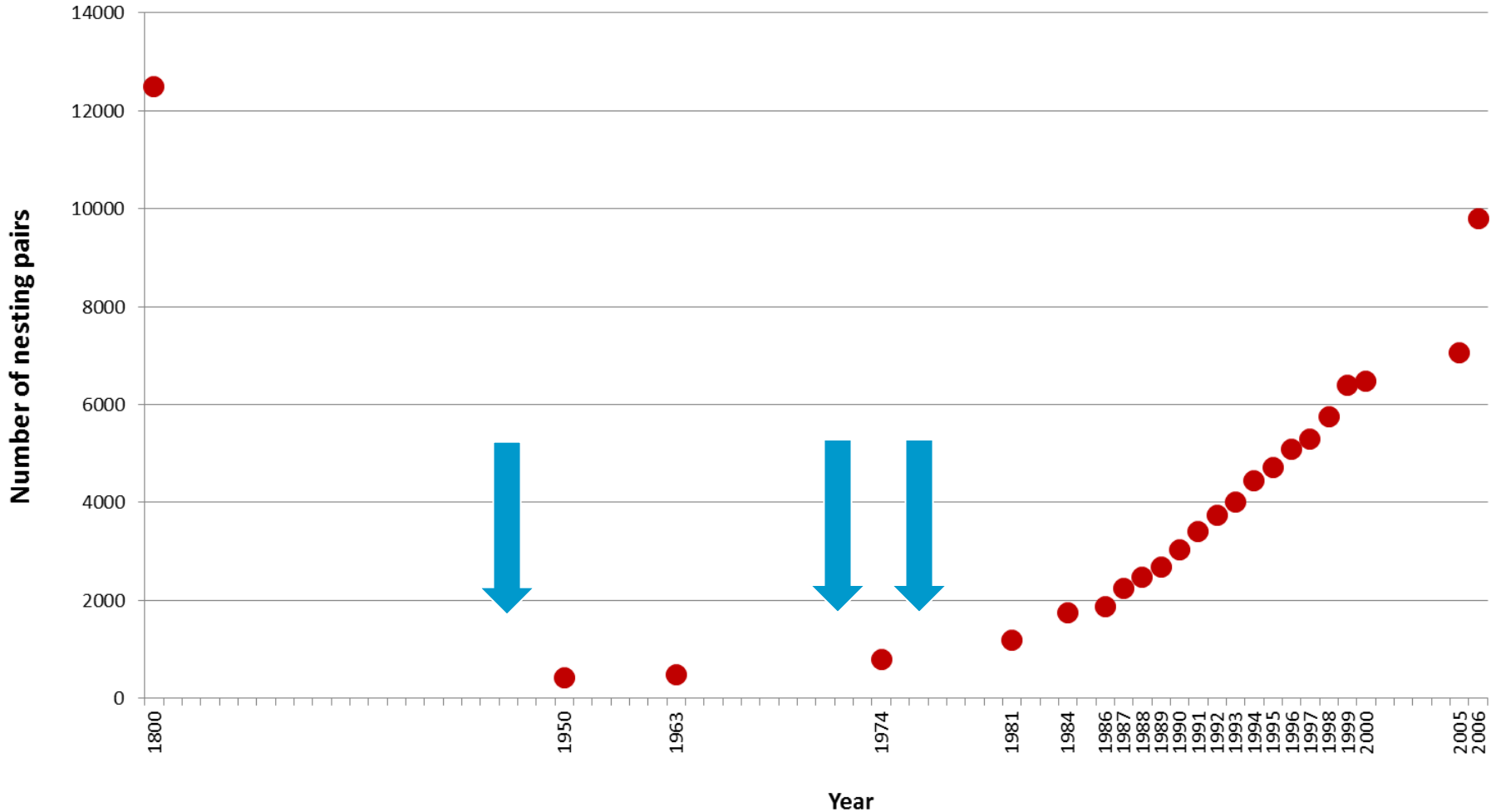
Great Lakes Inventory &
Monitoring Network



Bald eagle as a sentinel



Population decline & recovery (nesting pairs)



Monitoring 105 Chemicals

■ 2 Heavy metals

- Mercury
- Lead

■ 2 Legacy contaminants

- DDT & metabolites DDE/DDD
- PCBs (75 congeners)

■ 2 Emerging contaminants

- Perfluorinated compounds (PFCs; 16 analytes)
- Polybrominated diphenyl ethers (PBDEs; 9 congeners)

■ Added 39 more in 2010 & 2011 with GLRI \$\$

Focus on 4 contaminants

- **Mercury**
 - Lead
- **Brominated flame retardants**
- **Perfluorinated compounds**



Mercury

Great Lakes regional sources

57% Energy production (fossil fuels)

15% Incinerators and industry

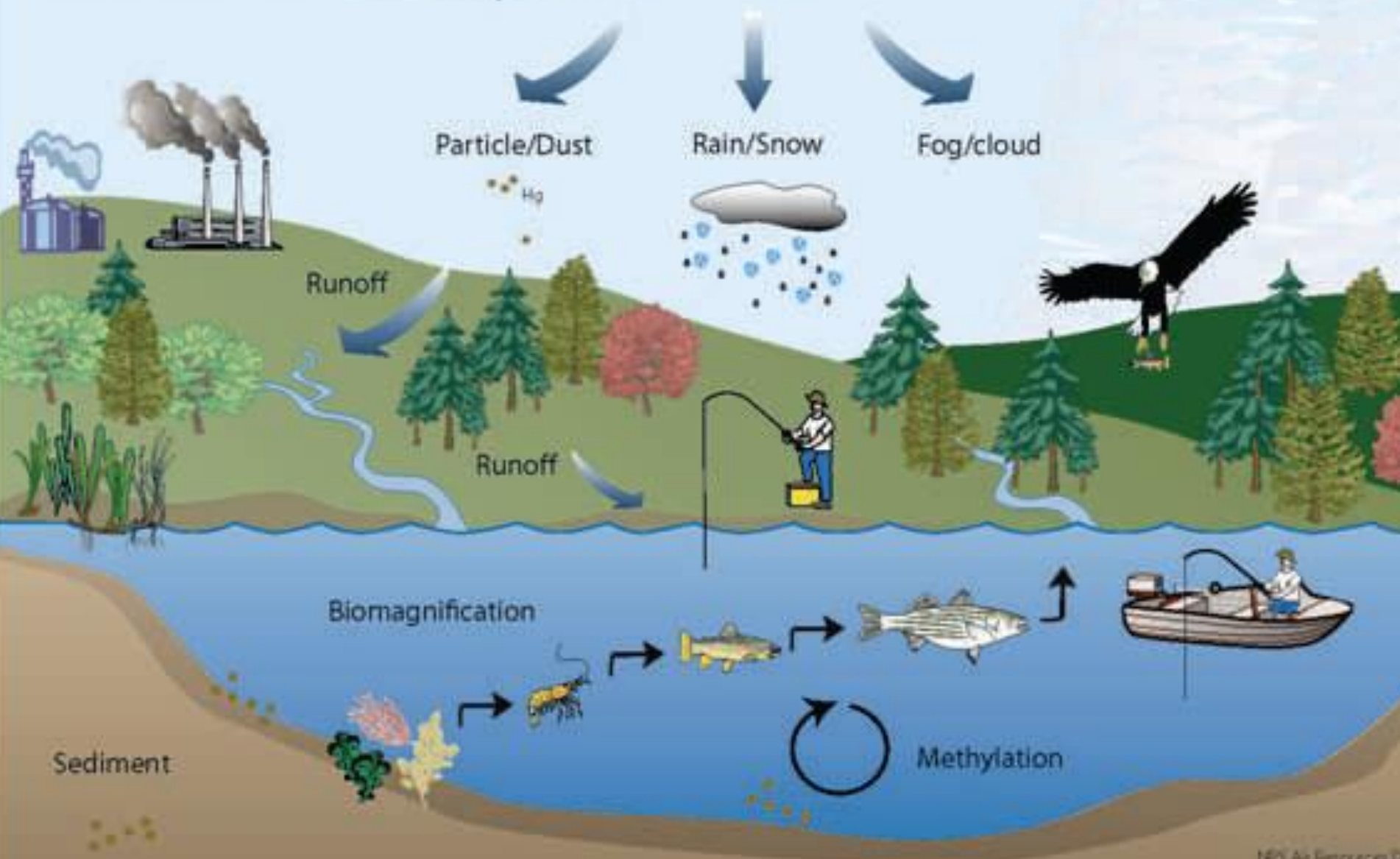
18% Other, includes metal mining/processing

Sources and Paths of Mercury in the Environment

Industrial Sources



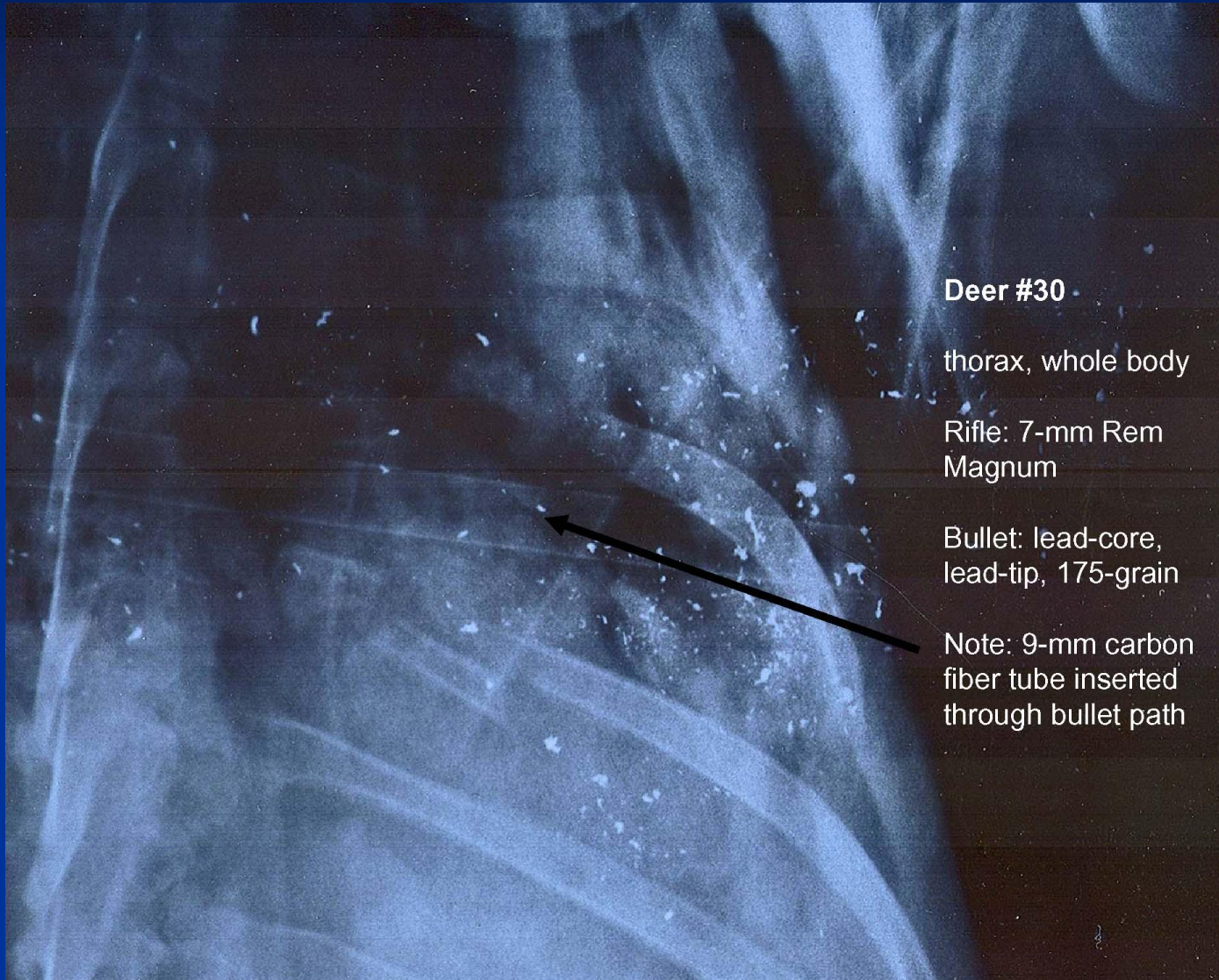
Mercury Deposition



Lead fishing sinkers/lures



Lead fragments in deer



Deer #30

thorax, whole body

Rifle: 7-mm Rem
Magnum

Bullet: lead-core,
lead-tip, 175-grain

Note: 9-mm carbon
fiber tube inserted
through bullet path

Flame retardants

Polybrominated diphenyl ethers (PBDEs)



Perfluorinated compounds

PFOS & PFOA



Pathways into the environment

- Emissions – air & water
- Leaching from landfills
- Direct consumption (prey/food)
- Dust (house)
- Out-gassing









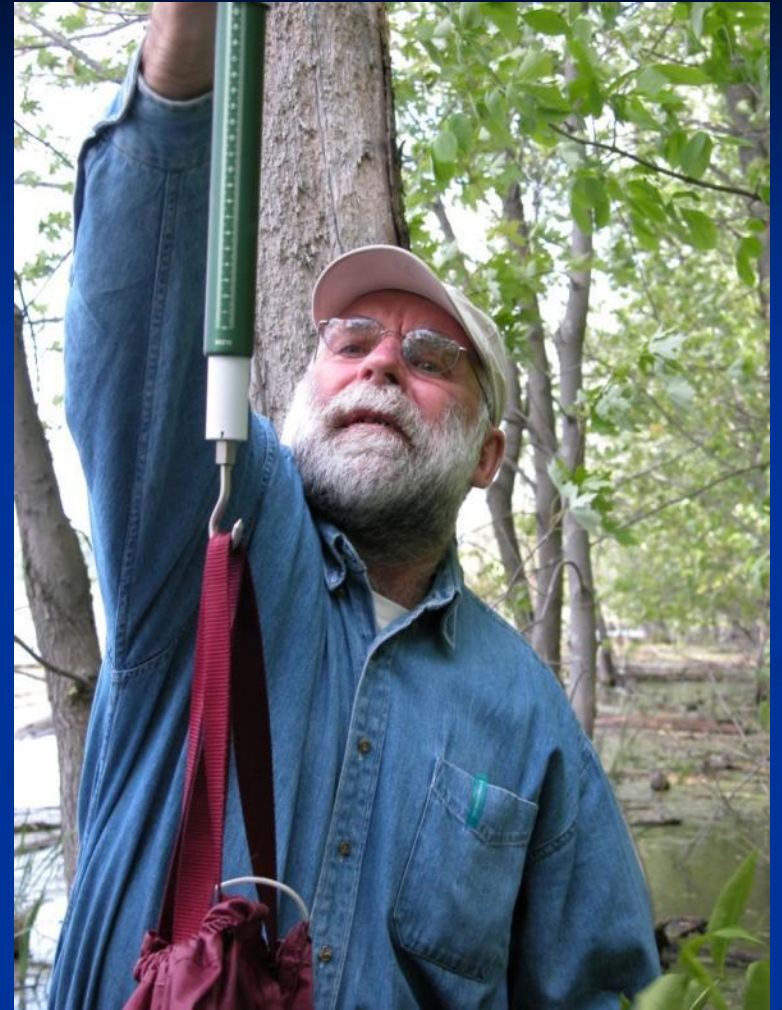
























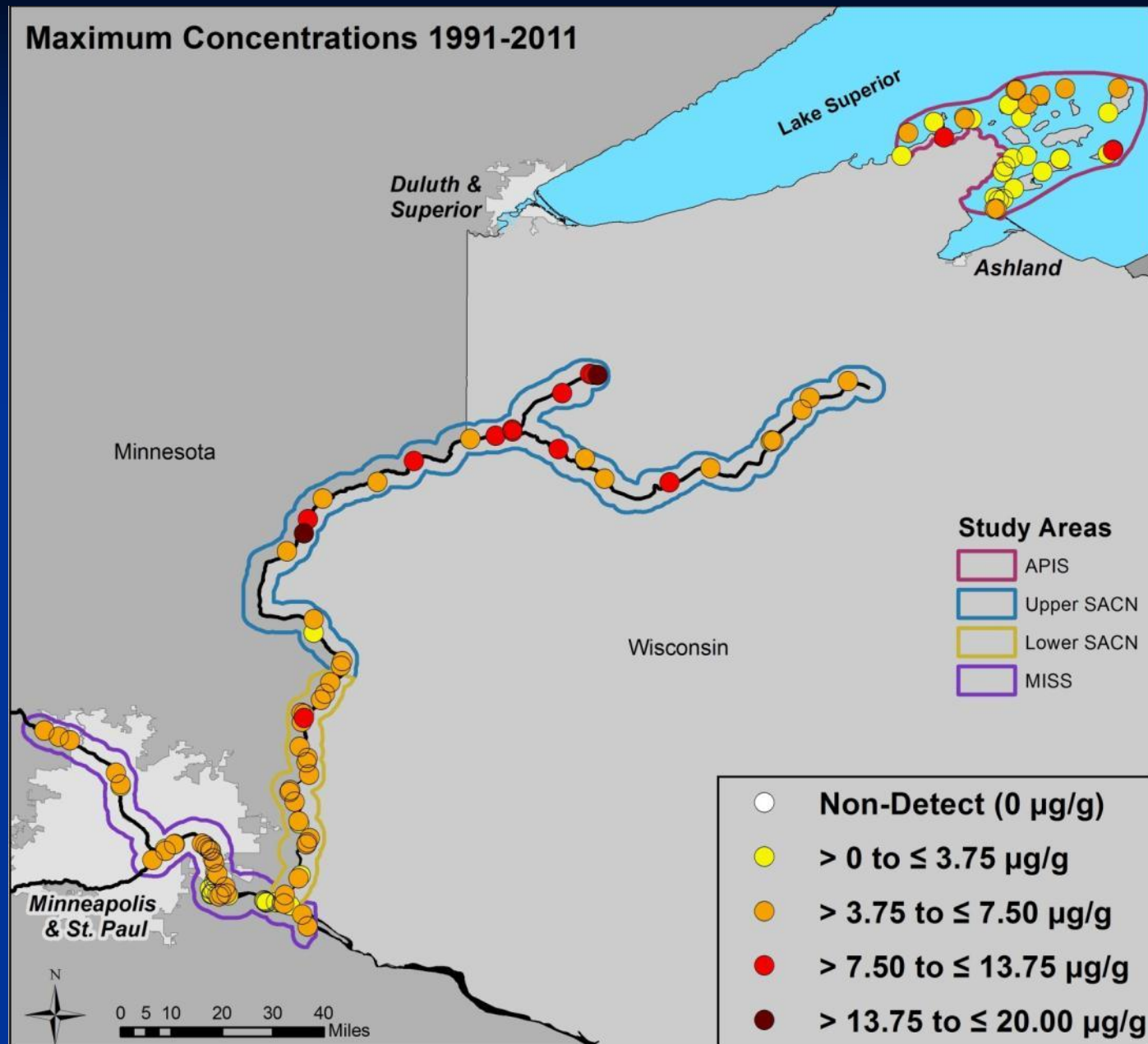






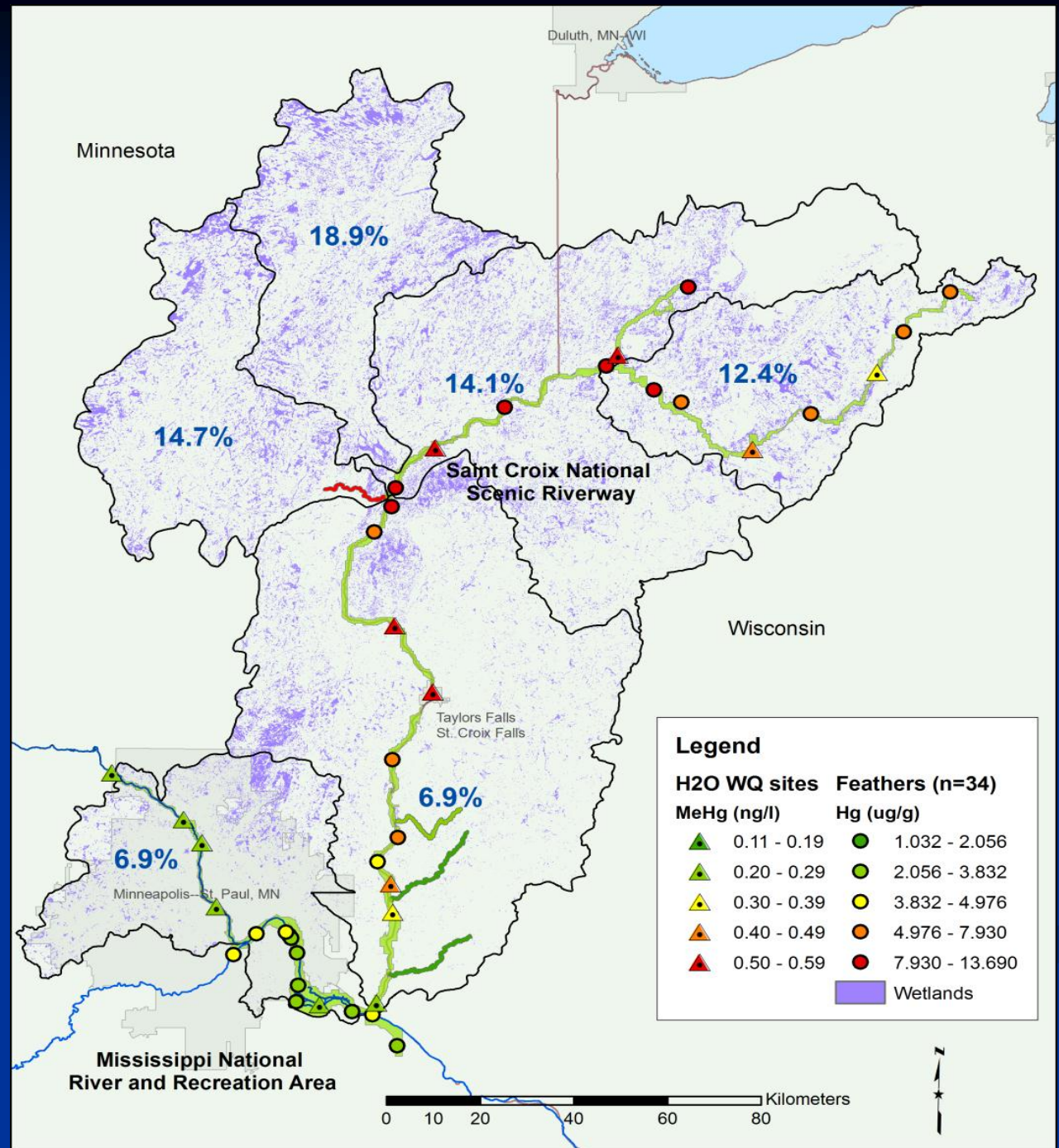
Mercury

Spatial patterns

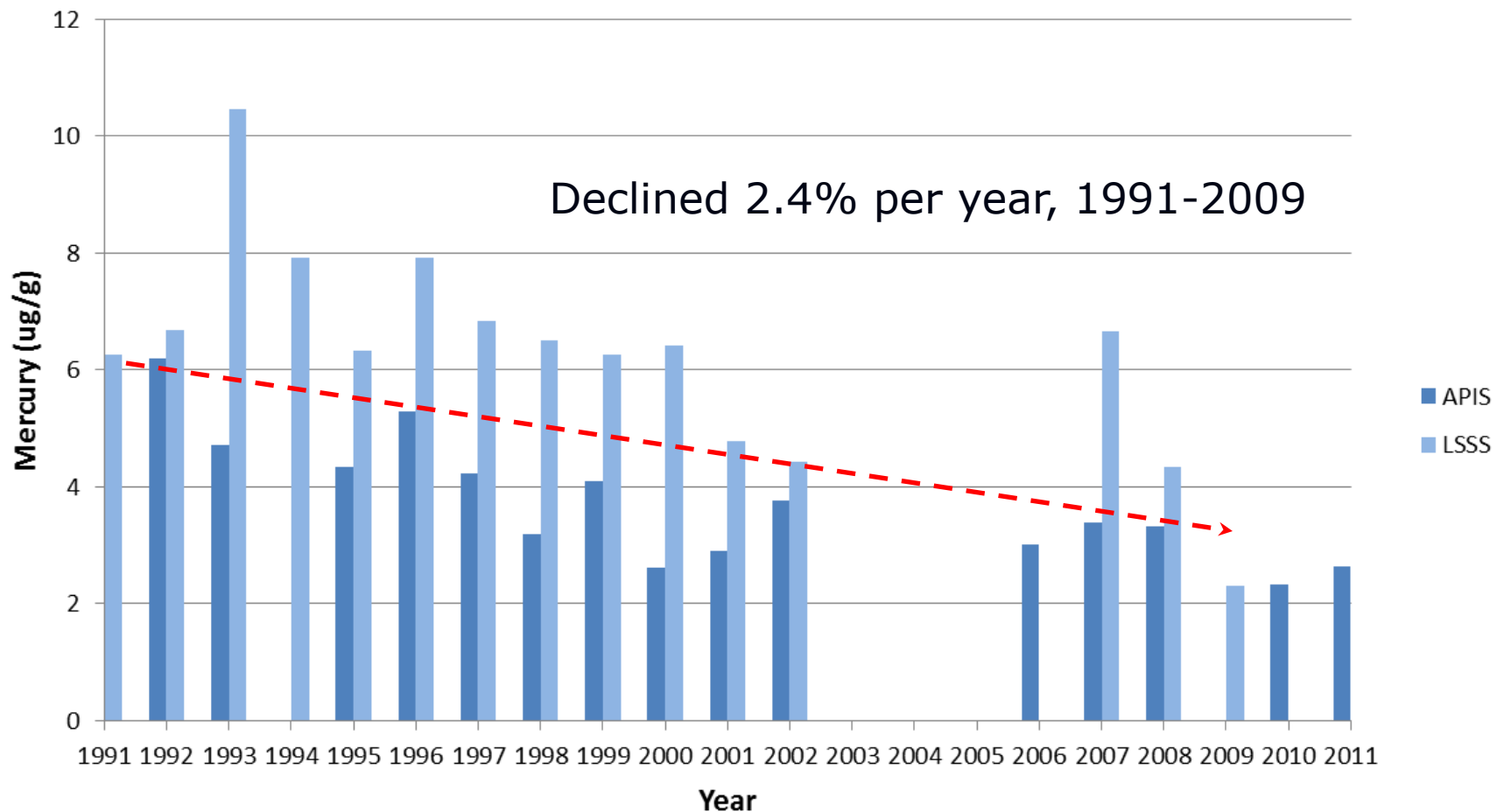


Mercury

Relationship to wetlands



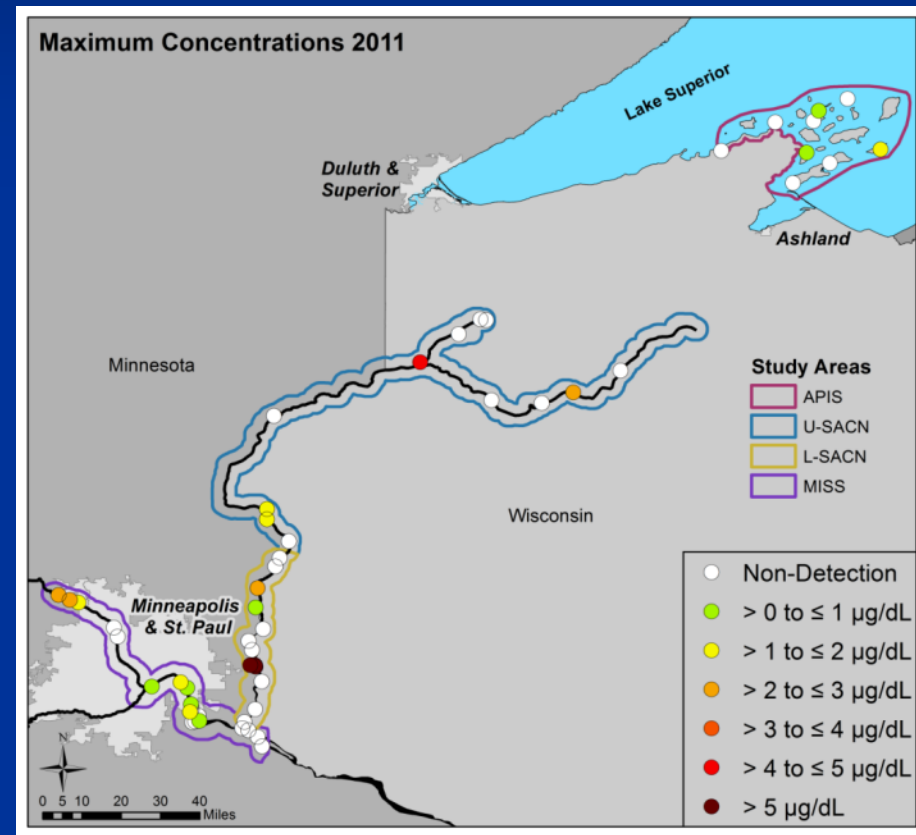
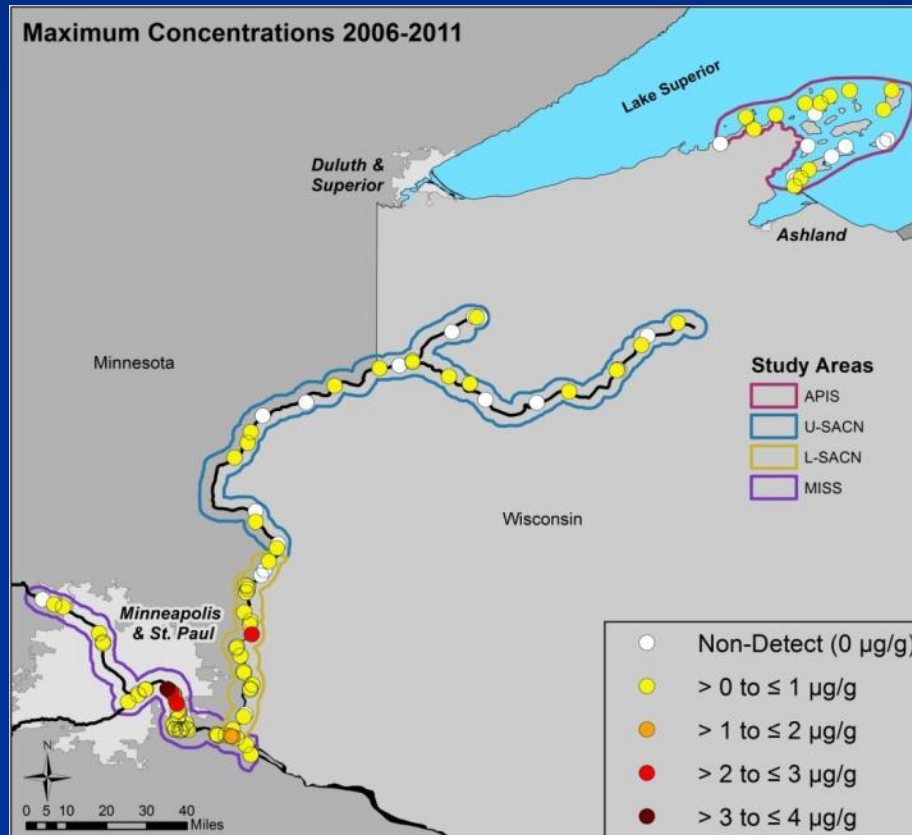
Mercury Trends



Lead Patterns

Feathers

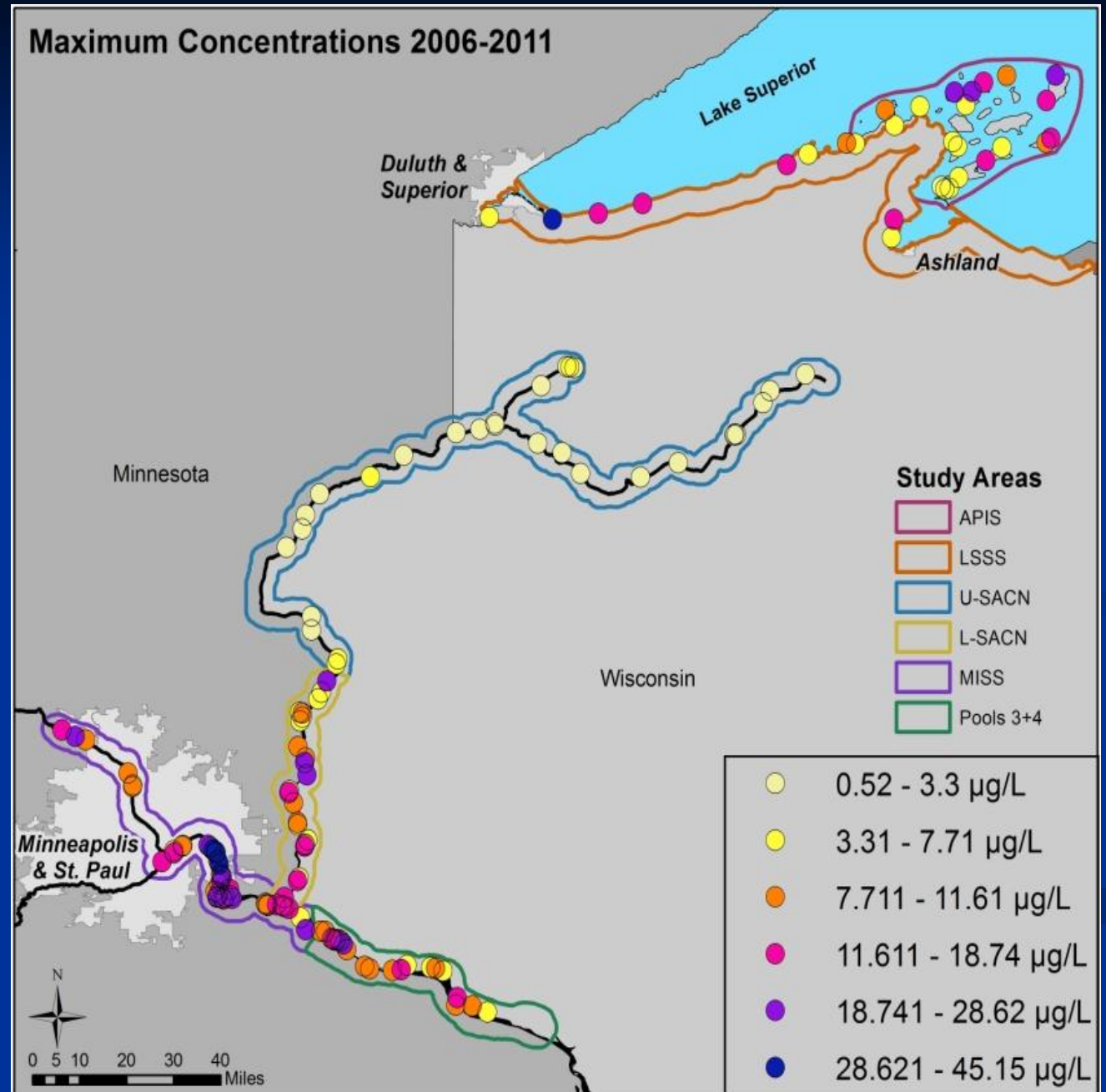
Blood



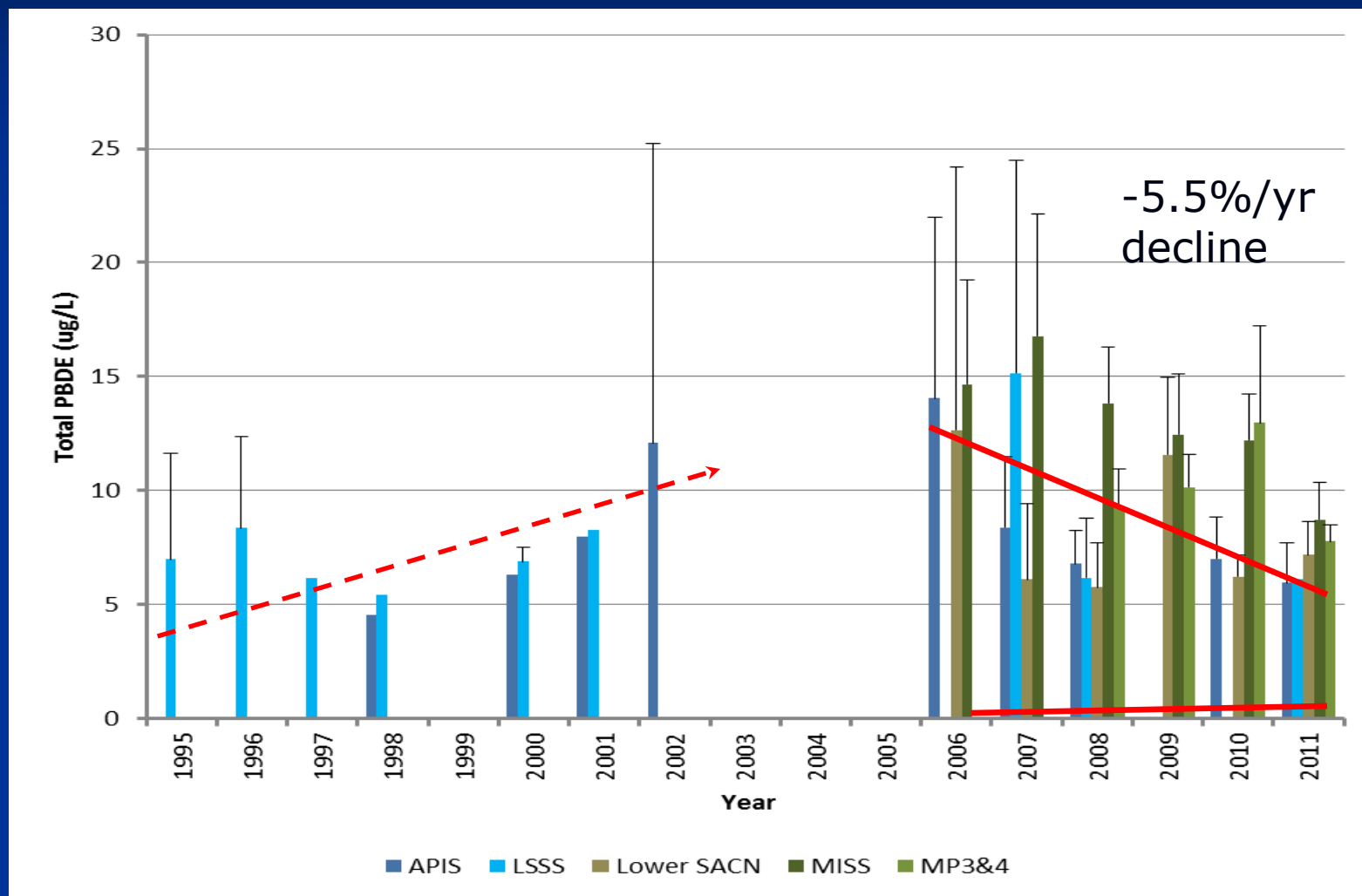
In preparation. Target: *Ecotoxicology*

ΣPBDE

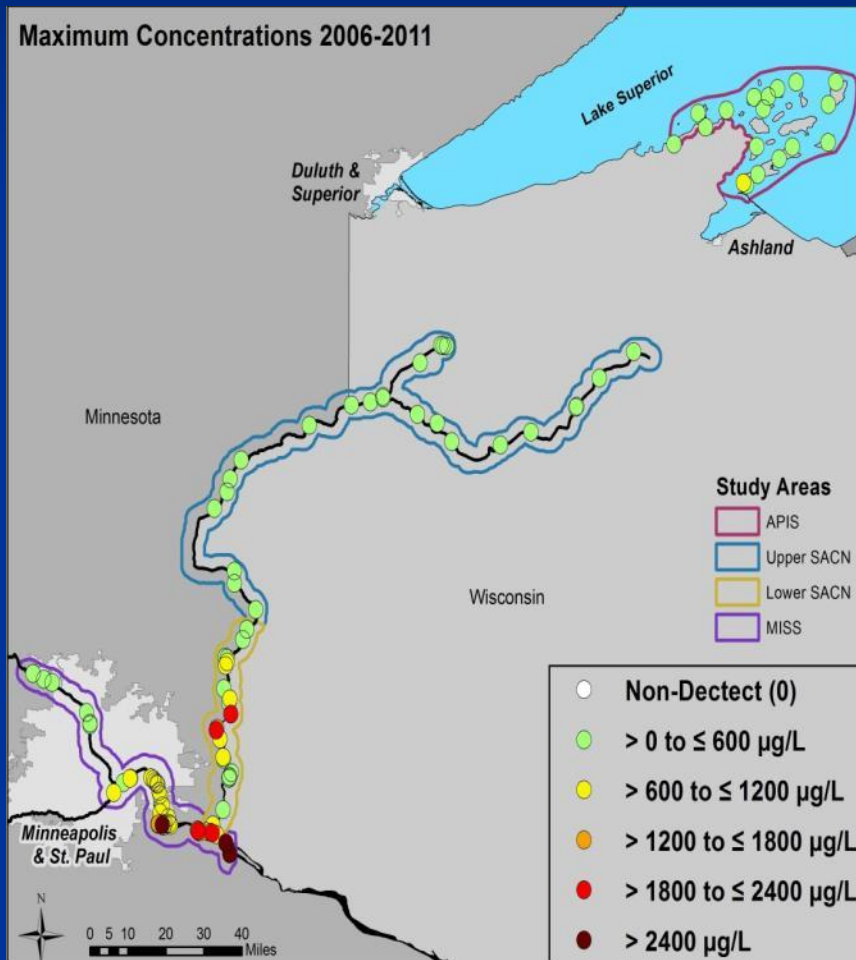
Spatial patterns



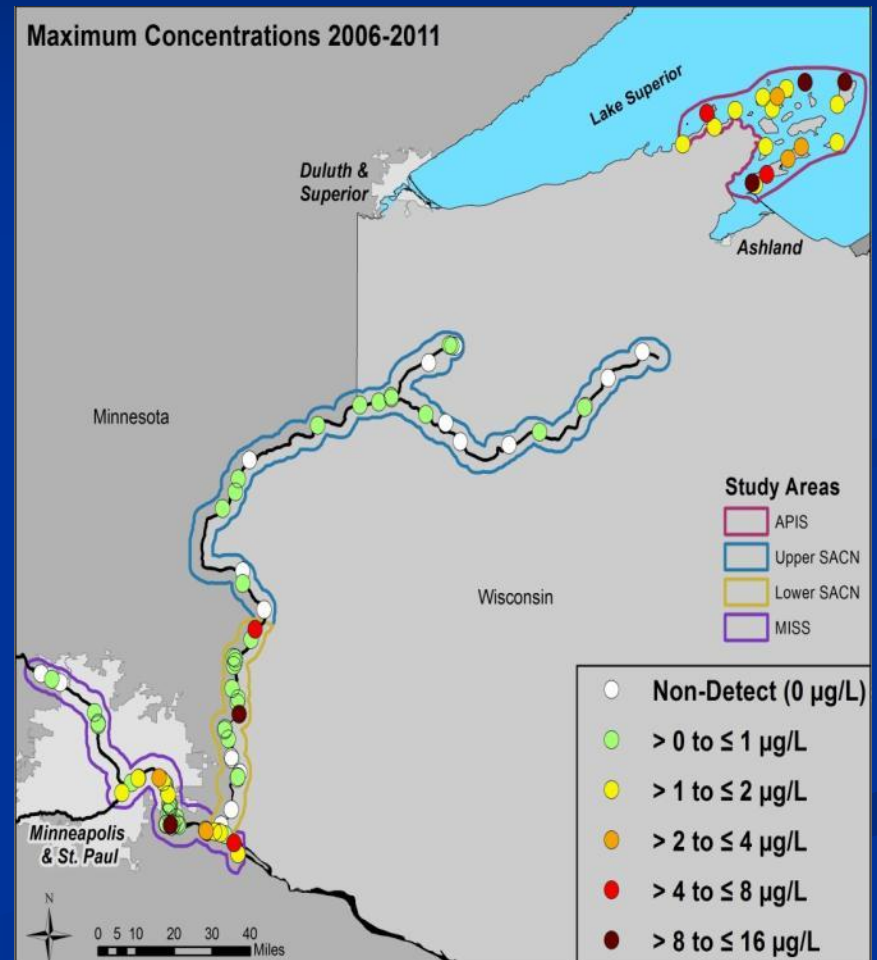
ΣPBDE Trends



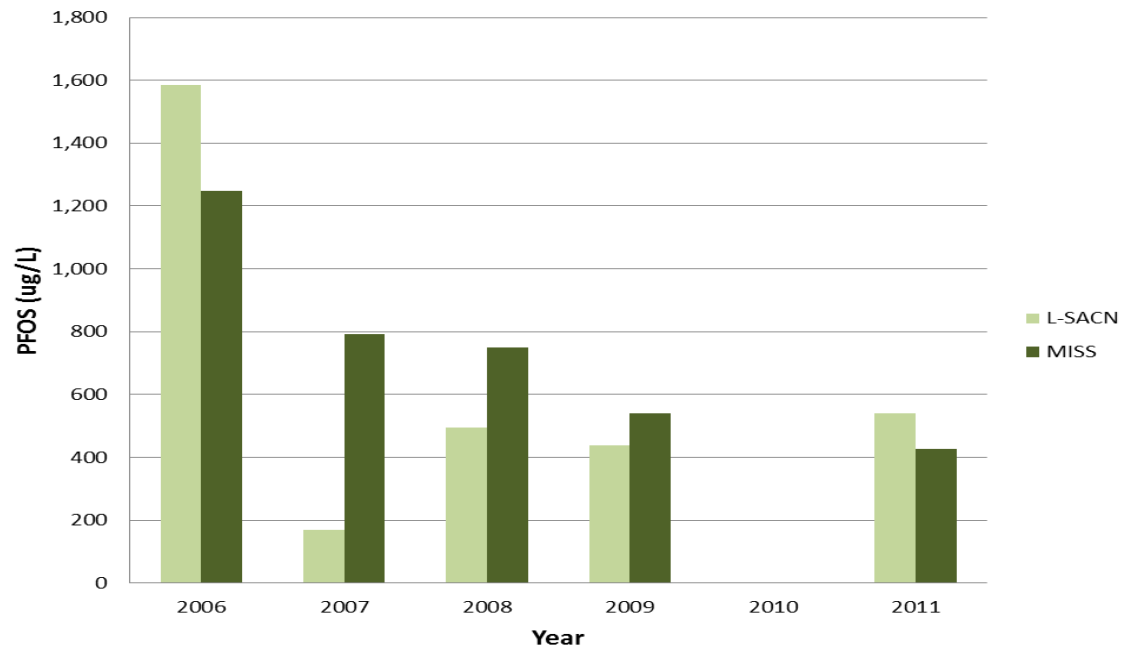
PFOS (Scotchgard)



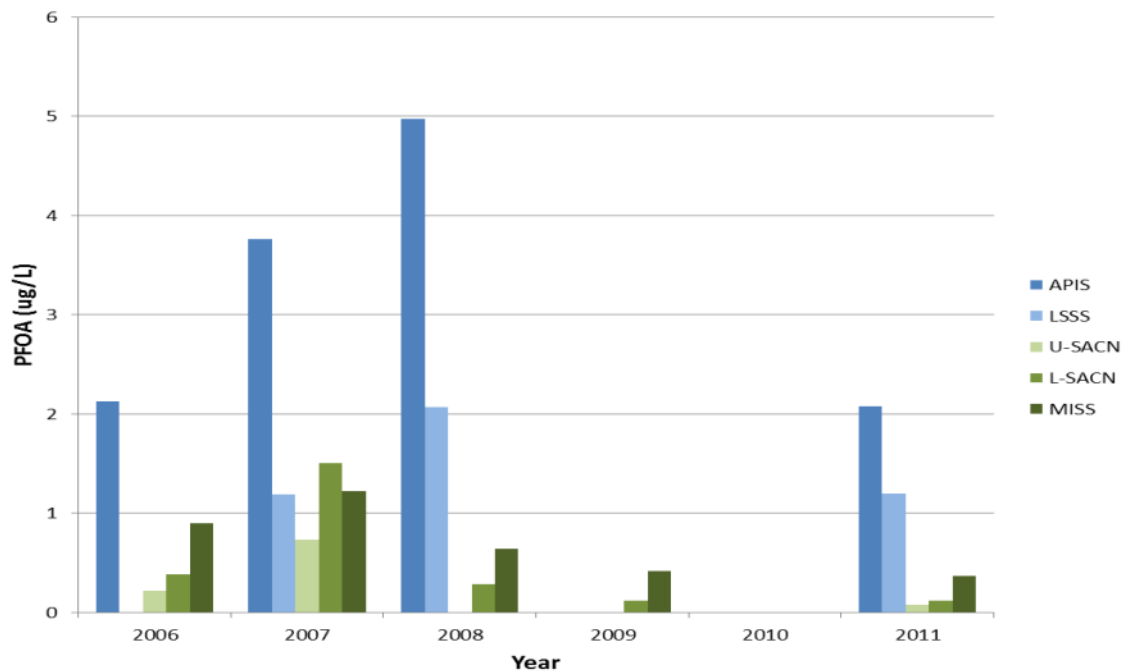
PFOA (Teflon)



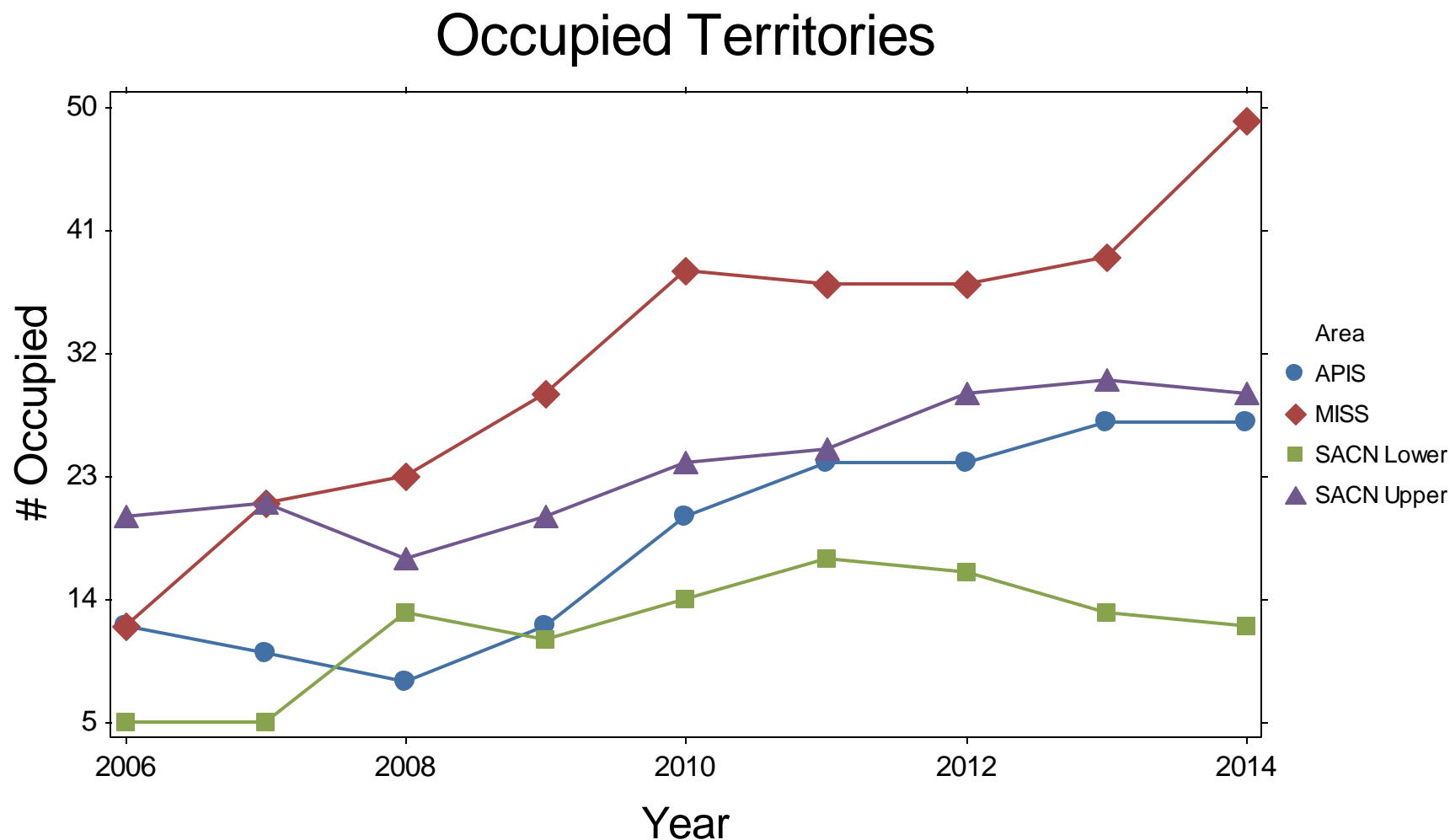
PFOS



PFOA



Population increase





The good news

- Declines in targeted contaminants
- Bald eagles have recovered
- ESA, Water Quality and Clean Air Acts can work

But...

- TSCA of 1976 is >35 years old
 - Innocent until proven guilty
 - Costly and takes years
 - Safe Chemicals Act of 2011 stalled in Congress
- Replacement chemicals unknown
 - Though green chemistry is increasing
- >80,000 chemicals
- Few evaluated for human health
- Sub lethal effects poorly understood
- Cumulative / synergistic effects unknown



Imodium
A-D
Anti-Diarrheal

NEW LOOK
Metamucil
Fiber Supplement

Maalox
ADVANCE
Antacid

Knox
NutraJoint
Glucosamine & Chondroitin

TUMS
EXTRA 750
Antacid

JOHNSON'S
DROPS
EYES

JOHNSON'S
DROPS
EYES

JOHNSON'S
DROPS
EYES

JOHNSON'S
DROPS
EYES

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 - 3M Corporation
 - Audubon Minnesota
 - Mississippi River Fund





Any
questions ?